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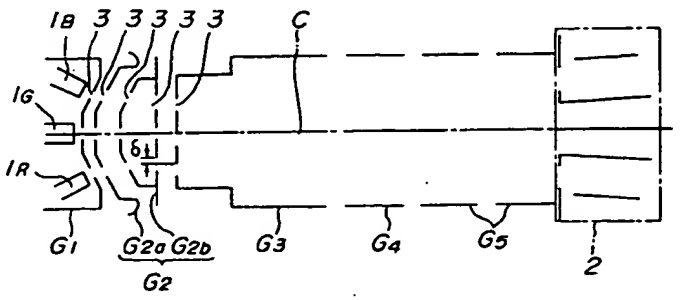
(54) Electron gun for color CRT.

(57) An electron beam for a color CRT is equipped with three cathodes such that three electron beams may be emitted therefrom. Three grids are provided with beam passing holes for each of the three electron beams and are positioned in the path of the electron beams. The beam passing openings of the third grid are shifted from alignment with the beam passing openings of the first and second grid by a degree sufficient to focus the three beams appropriately relative to a central focal axis of the electron gun.

FIG.1



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BACKGROUND OF THE INVENTION

Field of The Invention

The present invention relates generally to an lectron gun for a color CRT (cathode ray tube). Specifically, the present invention relates to a technique for correcting a spot shift amount for electron beams output by an electron gun of a color CRT.

Description of The Prior Art

In a color CRT it is preferable that a shift amount for spot movement of electron beams on a light receiving surface comes to zero. Spot shifting of electron beams is caused by geomagnetism, dimensional displacement of the electron gun in a thermal process, or the like. Conventionally, a magnetic shield plate is arranged on the CRT to minimize geomagnetic effects. However, spot shift due to other causes could not be prevented. New higher definition standards require that spot shift be held as low as possible to provide image stability and higher image definition.

SUMMARY OF THE INVENTION

It is therefore a principal object of the present invention to overcome the drawbacks of the prior art.

It is a further object of the present invention to provide an electron gun for a color CRT capable of easily correcting a shift amount of spot movement of lectron beams.

In order to accomplish the aforementioned and other objects, an electron gun for a color cathode ray tube is provided, comprising: three cathodes arranged in line with each other; a first grid having a first voltage applied thereto; a second grid having a second voltage applied thereto, the second voltage being higher than the first voltage; a third grid having a third voltage applied thereto, the third voltage being equal to an anode voltage of the lectron gun; the electron gun operable such that three electron beams emitted from the three cathod s are commonly focused at a main focusing lens after passing through respective apertures provided in the first, second and third grids and converged so as to be displayed on a phosphor screen panel; characterized in that: the apertures of the third grid are shifted in relation to the apertures of the second grid by a predetermined degree in parallel with an in line direction of the electron beams such that a focused position of th lectron beams is located on a center axis of th electron gun.

According to anoth r aspect of th invention, an lectron gun for a color CRT is provided, comprising: an electron gun for a color CRT, comprising: an lectron gun having three cathodes capable of ach mitting an lectron beam, r spectiv ly; a low potential first grid; a middle pot ntial second grid; and a high potential third grid, the first, second and third grids arranged such that three electron beams emitted from the three cathodes are focused after the beams pass through beam passing holes of the first, second and third grids, the beam passing holes of the third grid being shifted from alignment with the beam passing holes of the second grid by a degree sufficient to effect a focused position of the electron beams are appropriately aligned relative to a central axis.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Fig. 1 is a schematic block diagram of a color CRT according to the preferred embodiment of the invention;

Fig. 2 is a perspective view of a third grid used in the CRT of the preferred embodiment;

Fig. 3 is a representation of a conventional electron lens function of each grid when a beam passing through the third grid is not shifted; and

Fig. 4 is a representation of an electron lens function of each grid according to the invention, when a beam passing through the third grid is shifted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, particularly to Fig. 1, a schematic block diagram of an electron gun for a color CRT according to the preferred embodiment of the invention is shown. As may be seen in the drawing, the electron gun comprises three parallel and horizontally arranged cathodes 1_R, 1_G and 1_B for emitting three electron beams R, G and B. Five grids G_1 - G_5 are arranged consecutively in the path of the electron beams R, G and B. A convergence deflecting section 2 forming a unipotential lens, is also provided after the fifth grid G_5.

The electrical potential of the first grid G_1 is set to be lower than a potential of the three cathodes 1_R, 1_G and 1_B and the second grid G_2 comprises a main grid section G_2a and an auxiliary grid section G_2b and is set to a substantially middle electrical potential. The third grid G_3 and the fifth grid G_5 are set to a high potential substantially that of an anode (not shown) of said lectron gun. Th fourth grid is s t to a low to middl potential of 0 to 400v, for xample. Th three electron beams R, G, B are focused at th position of the fourth grid G_4 by receiving external force in th direction of a central

focal axis C.

Three beam passing holes 3b, 3g, 3r, are provided in each of the first grid G_1, the main grid section G_2a, the auxiliary grid section G_2b and the third grid G_3 respectively. The beam passing holes 3g, of grids G_1, G_2a and G_2b are formed so as to be substantially aligned with the focal axis C, while the beam passing holes 3b and 3r of each of the grids G_1, G_2a and G_2b are formed so as to be laterally and symmetrically oriented toward the focal axis C.

However, the holes 3b, 3g and 3r of the third grid G_3 are formed at a position on the third grid G_3 which is shifted by a value "δ" from a position aligned with the holes 3b, 3g and 3r of the first and second grids G_1 and G_2 in parallel with the directions of the electron beams R, G, and B. A process of determining the value of "δ" will be explained in detail hereinbelow.

Referring to Figs. 3 and 4, the functions of the grids are represented as electron lenses for representing the focusing properties of the beam passing holes 3b, 3g, 3r of the grids. According to this, the third grid G_3 serves as a concave lens 4, the fourth grid G_4 serves as a main lens 5 (convex lens), and the three electron beams are focused at the main lens 5. As seen in Fig. 3, is the positions of the beam passing holes of the third grid G_3 are not shifted, a focal convergence is not aligned with the focal axis C and spot shift occurs due to geomagnetism, dimensional displacement of the electron gun in thermal process, etc. Thus, if the beam passing holes 3 of the third grid G_3 are shifted in a direction so as to align the beams correctly relative to the focal axis C at the fourth grid G_4 the effect is the same as repositioning the concave lens 4. The amount of shift "δ" is thus determined to a point where the electron beams R, G, and B emitted from the three cathodes 1_R, 1_G and 1_B are focused at a position where they do not shift from the central axis C of the main lens 5.

According to this arrangement, the three electron beams R, G, B, from the three cathodes 1_R, 1_G, 1_B, are commonly converged and then pass through a color selection mask (not shown) to form an image on a light receiving surface (not shown) of the cathode ray tube, which light receiving surface may be a phosphor screen, or the like.

Further, as described above the present invention makes it possible to correct shift amounts for spot movement of electron beams R, G, B, not only due to geomagnetic influences but also spot shift due to any other cause, since the beam passing holes 3 of the third grid G_3 are shifted from alignment with the beam passing holes 3 of the second grid G_2 so that the focusing position of the electron beams is brought onto the central axis C. Moreover, this advantage may be implemented via a relatively simple design modification.

While the present invention has been disclosed in terms of the preferred embodiment in order to facilitate better understanding thereof, it should be appreciated that the invention can be embodied in various ways without departing from the principle of the invention. Therefore, the invention should be understood to include all possible embodiments and modification to the shown embodiments which can be embodied without departing from the principle of the invention as set forth in the appended claims.

Claims

1. An electron gun for a color cathode ray tube, comprising:
   three cathodes arranged in line with each other;
   a first grid having a first voltage applied thereto;
   a second grid having a second voltage applied thereto, said second voltage being higher than said first voltage;
   a third grid having a third voltage applied thereto, said third voltage being equal to an anode voltage of said electron gun;
   said electron gun operable such that three electron beams emitted from said three cathodes are commonly focused at a main focusing lens after passing through respective apertures provided in said first, second and third grids and converged so as to be displayed on a phosphor screen panel;
   characterized in that:
   the apertures of said third grid are shifted in relation to said apertures of said second grid by a predetermined degree in parallel with an in line direction of said electron beams such that a focused position of said electron beams is located on a center axis of said electron gun.

2. An electron gun as set forth in claim 1, wherein said second grid comprises a main grid portion and an auxiliary grid portion, each of said main and auxiliary grid portions having beam passing apertures for each of said electron beams, respectively.

3. An electron gun as set forth in claim 1, wherein said apertures of said first grid are aligned with said apertures of said second grid.

4. An electron gun as set forth in claim 1, wherein said focused position of said electron beams after passing through said apertures of said third grid are focused on a fourth grid set after

said third grid along a path of said electron beams.

5. An lectron gun as s t forth in claim 4, wher in said fourth grid is set to a voltage of 0 to 400v.

6. An electron gun as set forth in claim 1, wherein an voltage of said first grid set to be lower than a voltage of said three cathodes.

7. An electron gun as set forth in claim 4, further comprising a fifth grid set after said fourth grid along said path of said electron beams.

8. An electron gun as set forth in claim 7, wherein said third grid and said fifth grid are set to a voltage substantially equal to that of an anode of said electron gun.

9. An electron gun for a color CRT, comprising:

an electron gun having three cathodes capable of each emitting an electron beam, respectively;

a low potential first grid;

a middle potential second grid; and

a high potential third grid, said first, second and third grids arranged such that three electron beams emitted from said three cathodes are focused after the beams pass through beam passing holes of said first, second and third grids, said beam passing holes of said third grid being shifted from alignment with said beam passing holes of said second grid by a degree sufficient to effect a focused position of said electron beams are appropriately aligned relative to a central axis of said electron gun.

10. An electron gun as set forth in claim 9, wherein said second grid comprises a main grid portion and an auxiliary grid portion, each of said main and auxiliary grid portions having beam passing holes for each of said electron beams, respectively.

11. An electron gun as set forth in claim 9, wherein said beam passing holes of said first grid are aligned with said beam passing holes of said second grid.

12. An electron gun as set forth in claim 9, wherein said focused position of said electron beams after passing through said beam passing holes of said third grid ar focused on a fourth grid set aft r said third grid along a path of said lectron beams.

13. An lectron gun as set forth in claim 12, wherein said fourth grid is set to a low to middl potential of 0 to 400v.

14. An electron gun as set forth in claim 9, wherein an electrical potential of said first grid set to be lower than a potential of said three cathodes.

15. An electron gun as set forth in claim 9, wherein said second grid comprises a main grid section and an auxiliary grid section which are set to a substantially middle electrical potential.

16. An electron gun as set forth in claim 12, further comprising a fifth grid set after said fourth grid along said path of said electron beams.

17. An electron gun as set forth in claim 16, wherein said third grid and said fifth grid are set to a high potential substantially equal to that of an anode of said electron gun.

FIG.1

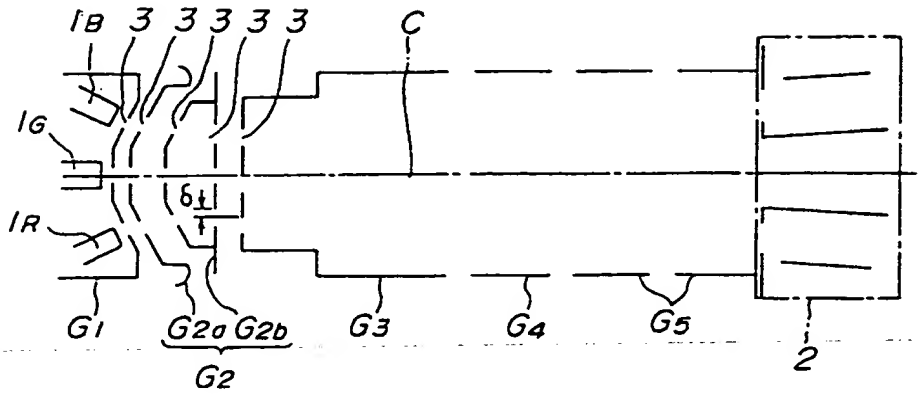


FIG.2

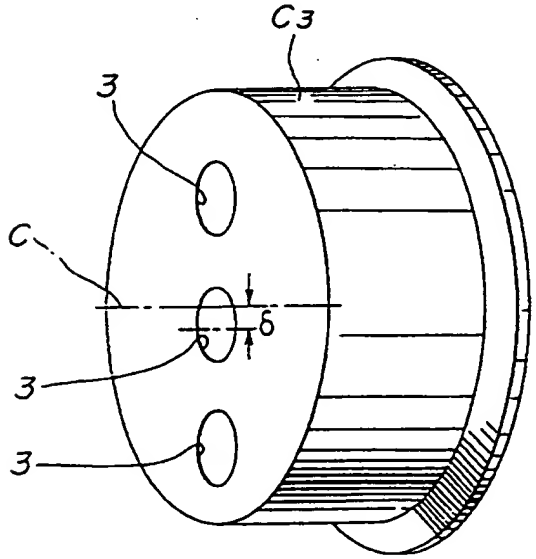


FIG.3

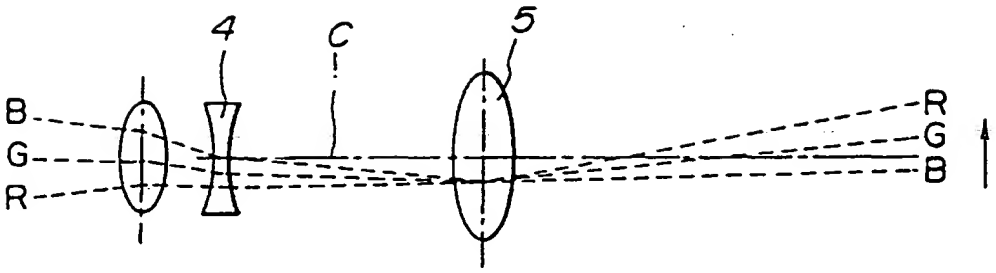
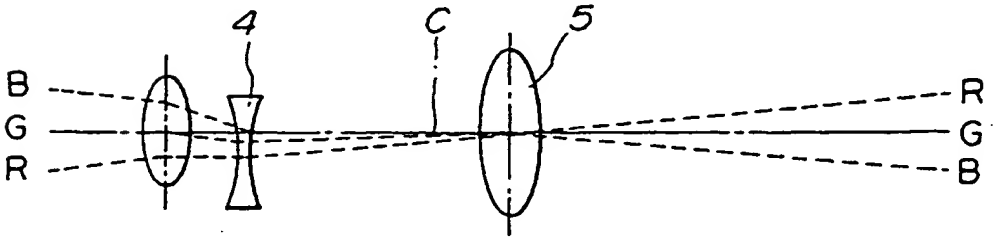


FIG.4



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EUROPEAN SEARCH REPORT

Application Number

EP 93 10 6266

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	DE-A-2 934 498 (LICENTIA-PATENT) * page 6, line 1 - page 7, line 23 * * figure 2 *	1,9	H01J29/00 H01J29/50
A	PATENT ABSTRACTS OF JAPAN vol. 2, no. 104 (E-78) & JP-A-53 70 663 (TOKYO SHIBAURA) 23 June 1978 * abstract *	1,9	
A	US-A-5 039 906 (I. PARK) * the whole document *	1,9	
A	US-A-4 922 166 (K. ICHIDA ET AL.) * Abstract * * figure 1 *	1,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

H01J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 AUGUST 1993	DAMAN M.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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